# PART B

**1. Find the Values of 'a' and 'b' so that the surfaces** $ax^3 - by^2z = (a+3)x^2$ **and**

$4x^2y - z^3 = 11$ **may cut orthogonally at (2,-1,-3).**

**2. Prove** $\vec{F} = (y^2\cos x + z^3)\vec{i} + (2y\sin x - 4)\vec{j} + 3xz^2\vec{k}$ **is irrotational and find its scalar potential** $\varphi$**.**

**3. Show that** $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$ **is Irrotational vector and the scalar potential function** $\phi$ **Such that** $\vec{F} = \nabla\varphi$**.**

**4.Find the constants a,b and c so that** $\vec{F}$ **may be irrotational Where** $\vec{F} = (axy + bz^3)\vec{i} + (3x^2 - cz)\vec{j} + (3xz^2 - y)\vec{k}$ **and for these values of a,b,c find the scalar potential of** $\vec{F}$**.**

**5. If** $\vec{F} = (3x^2 + 6y)\vec{i} + 14yz\vec{j} + 20xz^2\vec{k}$ **,evaluate** $\int_C F.\vec{dr}$ **from (0,0,0) to (1,1,1) over the curve** $x = t, y = t^2, z = t^3$**.**

**6.Find the work done when a force** $\vec{F} = (y+3)\vec{i} + xz\vec{j} + (yz - x)\vec{k}$ **,moves a particle from (0,0,0) to (2,1,1) along the curve** $x = 2t^2, y = t, z = t^3$**.**

**7. Evaluate** $\iint_S \vec{F}.\vec{n}ds$ **where** $\vec{F} = 18z\vec{i} - 12\vec{j} + 3y\vec{k}$ **as S is the part of the plane** $2x + 3y + 6z = 12$ **Which is in the first octant?**

**8. Verify Green's theorem in the plane for** $\int (3x^2 - 8y^2)dx - (4y - 6xy)dy$ **where C is The boundary of the region defined by** $x = y^2, y = x^2$**.**

**9. Evaluate by Green's theorem,** $\int_C (e^{-x}\sin y\,dx + \cos y\,dx)$ **C being the rectangle with vertices (0,0) ,(π,0),( π, π/2) and (0, π/2).**

**10. State Green's theorem. Verify the theorem for** $\oint_C (xy^2 - 2xy)dx + (x^2y + 3)dy$ **around of C of the region enclosed by** $y^2 = 8x$ **and x= 2.**

**11. Apply Green's theorem in the plane to evaluate** $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ **Where C is the boundary of the region enclosed by** $y = \sqrt{x}$ **and** $y = x^2$**.**

**12. Evaluate** $\int [(2xy - x^2)dx - (x + y^2)dy]$ **using Green's theorem where C is the Closed curve formed by** $x = y^2, y = x^2$ .

**13.Verify Green's theorem in the plane for** $\int (xy + y^2)dx - x^2dy$ **where C is the boundary of the common area between** $y = x^2, y^2 = x$ .

**14.Verify Green's theorem in the plane for** $\int (xy + y^2)dx - x^2dy$ **where C is the boundary of the common area between** $y = x^2, y = x$ .

**15. Apply Green's theorem in the plane to evaluate** $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ **where C is the boundary of the region defined by x=0 , y=0 and x + y =1.**

**16. Verify Gauss divergence theorem for $\vec{F}=(x^2-yz)\vec{i}+(y^2-zx)\vec{j}+(z^2-xy)\vec{k}$ taken Over the rectangular parallelepiped $0\le x\le a, 0\le y\le b, 0\le z\le c$.**

**17. Verify Gauss divergence theorem for the function $\vec{F}=y\vec{i}+x\vec{j}+z^2\vec{k}$ where S is the surface of the cuboids formed by the planes x=0,x=1,y=0,y=2,z=0,z=3.**

**18. Verify Gauss divergence theorem for the function $\vec{F}=4xz\vec{i}-y^2\vec{j}+yz\vec{k}$ over the cube x=0,x=1,y=0,y=1,z=0,z=1.**

**19. Verify divergence theorem for $\vec{F}=4xz\vec{i}-y^2\vec{j}+yz\vec{k}$ when S is the closed surface of the Cube formed by x =0 , x=1, y=0 y=1 , z=0 , z=1**

**20.Evaluate by Stoke's theorem $\int_C \vec{F}.d\vec{r}$ where $\vec{F}=\sin z\vec{i}-\cos x\vec{j}+\sin y\vec{k}$ where C is the boundary of the common area between $y=x^2, y=x$.**

**21.Verify Stokes's theorem for $\vec{F}=(x^2+y^2)\vec{i}-2xy\vec{j}$ taken around the rectangle bounded by the lines $x=\pm a, y=0, y=b$.**

**22.Verify Stoke's theorem for $\vec{F}=(y-z+2)\hat{i}+(yz+4)\hat{j}-xz\hat{k}$ over the open surfaces of the cube x =0,y =0 , z=0 , x=1, y=1, z=1 not included in the XOY plane.**

**23.Verify Stoke's theorem for a vector defined by $\vec{F}=(x^2-y^2)\vec{i}+2xy\vec{j}$ in the rectangular region in the XOY plane obtained by the lines x=0, x=a, y=0 and y=b.**